

WHAT IS CLAIMED IS:

1. A catalyst complex comprising a water insoluble metal cyanide catalyst that is complexed with a monomer complexing agent that has at least one polymerizable site of carbon-carbon unsaturation.
- 5 2. The catalyst complex of claim 1, which is represented by the general structure

$$M_b[M^1(CN)_r(X)_t]_c[M^2(X)_6]_d \cdot zL \cdot nM^3_xA_y$$
 wherein M is a metal ion that forms an insoluble precipitate with the $M^1(CN)_r(X)_t$ group;
 M^1 and M^2 are transition metal ions that may be the same or different;
 10 each X independently represents a group other than cyanide that coordinates with an M^1 or M^2 ion;
 $M^3_xA_y$ represents salt of metal ion M^3 and anion A, wherein M^3 is the same as or different than M;
 b and c are positive numbers that, together with d, reflect an electrostatically
 15 neutral complex;
 d is zero or a positive number;
 x and y are numbers that reflect an electrostatically neutral salt;
 r is from 4 to 6; t is from 0 to 2;
 n is a positive number indicating the relative quantity of $M^3_xA_y$;
 20 L represents the complexing agent and z is a positive number representing the relative quantity of complexed L molecules.
3. The catalyst complex of claim 2, which is a zinc hexacyanocobaltate catalyst complex wherein M^3 is zinc.
4. The catalyst complex of claim 1, wherein the monomer complexing agent is a
 25 vinyl monomer containing a nitrogen or oxygen atom.
5. The catalyst complex of claim 4, wherein the monomer complexing agent is vinyl acetate, vinyl ethyl ether, vinyl 2-ethylhexanoate, vinyl isobutyl ether, vinyl methyl ketone, 1-vinyl-2-pyrrolidinone or a mixture of two or more thereof.
6. The catalyst complex of claim 1, wherein the monomer complexing agent is
 30 acrylamide, methacrylamide, an N,N-dialkyl acrylamide or an N,N-dialkyl methacrylamide.
7. The catalyst complex of claim 1, wherein the monomer complexing agent is an acrylic or methacrylic ester.

8. The catalyst complex of claim 7, wherein the acrylic or methacrylic ester has one or more ether and/or alcohol groups in the ester portion of the molecule.

9. The catalyst complex of claim 8, wherein the acrylic or methacrylic ester is represented by the general structure



where R is hydrogen or methyl, x is a number that is at least 1 and R¹ is (1) the residue of a compound having from 1-8 aliphatic hydroxyl groups, (2) the residue of a phenol or bisphenol.

10. The catalyst complex of claim 9, wherein the acrylic or methacrylic ester is

10 (A) an ester of one or more moles of acrylic or methacrylic acid and a mole of propylene glycol, ethylene glycol, trimethylolpropane, neopentyl glycol, pentaerythritol, glycerine, dipropylene glycol, diethylene glycol or an ethoxylated and/or propoxylated derivative of any of the foregoing,

(B) a complex ester of one or more moles of acrylic or methacrylic acid and (a) one or
15 more moles of a C₆-C₂₄ straight chain saturated or unsaturated carboxylic acid and (b) propylene glycol, ethylene glycol, trimethylolpropane, neopentyl glycol, pentaerythritol, glycerine, dipropylene glycol, diethylene glycol or an ethoxylated and/or propoxylated derivative of any of the foregoing; or

(C) a mixture of two or more of (A) and/or (B).

20 11. A polymer having dispersed therein a metal cyanide catalyst that is complexed with said polymer, formed by subjecting the catalyst complex of claim 1 to conditions sufficient to polymerize the monomer complexing agent.

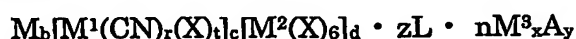
12. A polymer having dispersed therein a metal cyanide catalyst that is complexed with said polymer, formed by subjecting the catalyst complex of claim 3 to
25 conditions sufficient to polymerize the monomer complexing agent.

13. A polymer having dispersed therein a metal cyanide catalyst that is complexed with said polymer, formed by subjecting the catalyst complex of claim 4 to conditions sufficient to polymerize the monomer complexing agent.

14. A polymer having dispersed therein a metal cyanide catalyst that is
30 complexed with said polymer, formed by subjecting the catalyst complex of claim 5 to conditions sufficient to polymerize the monomer complexing agent.

15. A polymer having dispersed therein a metal cyanide catalyst that is complexed with said polymer, formed by subjecting the catalyst complex of claim 6 to conditions sufficient to polymerize the monomer complexing agent.

16. A polymer having dispersed therein a metal cyanide catalyst that is complexed with said polymer, formed by subjecting the catalyst complex of claim 7 to conditions sufficient to polymerize the monomer complexing agent.
17. A polymer having dispersed therein a metal cyanide catalyst that is
5 complexed with said polymer, formed by subjecting the catalyst complex of claim 9 to conditions sufficient to polymerize the monomer complexing agent.
18. A polymer having dispersed therein a metal cyanide catalyst that is complexed with said polymer.
19. The polymer of claim 18, wherein the polymer is a polymer of a vinyl
10 monomer containing a nitrogen or oxygen atom.
20. The polymer of claim 19, wherein the polymer is a polymer of acrylamide, methacrylamide, an N,N-dialkyl acrylamide or an N,N-dialkyl methacrylamide.
21. The polymer of claim 19, wherein the polymer is a polymer of an acrylic or methacrylic ester.
- 15 22. The polymer of claim 18, wherein the polymer is a polymer of
(A) an ester of one or more moles of acrylic or methacrylic acid and a mole of propylene glycol, ethylene glycol, trimethylolpropane, neopentyl glycol, pentaerythritol, glycerine, dipropylene glycol, diethylene glycol or an ethoxylated and/or propoxylated derivative of any of the foregoing,
20 (B) a complex ester of one or more moles of acrylic or methacrylic acid and (a) one or more moles of a C₆-C₂₄ straight chain saturated or unsaturated carboxylic acid and (b) propylene glycol, ethylene glycol, trimethylolpropane, neopentyl glycol, pentaerythritol, glycerine, dipropylene glycol, diethylene glycol or an ethoxylated and/or propoxylated derivative of any of the foregoing; or
25 (C) a mixture of two or more of (A) and/or (B).
23. A method of making a polymerization catalyst, comprising
a) treating a metal cyanide catalyst with a complexing agent having at least one site of polymerizable carbon-carbon unsaturation, and
b) subjecting said treated catalyst to conditions sufficient to polymerize said
30 complexing agent to form a polymer containing the metal cyanide catalyst dispersed within it.
24. The method of claim 23, wherein the metal cyanide catalyst is represented by the general structure



wherein M is a metal ion that forms an insoluble precipitate with the $M^1(CN)_r(X)_t$ group;

M^1 and M^2 are transition metal ions that may be the same or different;

each X independently represents a group other than cyanide that coordinates with an M^1 or M^2 ion;

$M^3_xA_y$ represents salt of metal ion M^3 and anion A, wherein M^3 is the same as or different than M;

b and c are positive numbers that, together with d, reflect an electrostatically neutral complex;

d is zero or a positive number;

x and y are numbers that reflect an electrostatically neutral salt;

r is from 4 to 6; t is from 0 to 2;

n is a positive number indicating the relative quantity of $M^3_xA_y$;

L represents the complexing agent and z is a positive number representing the relative quantity of complexed L molecules.

25. The method of claim 24, wherein the polymerization is performed in the presence of a free radical initiator.

26. The method of claim 24, wherein the metal cyanide catalyst is precipitated from starting solutions or suspensions, and step b) is conducted simultaneously with the precipitation of the catalyst.

27. The method of claim 25, wherein the free radical initiator is an azo-type initiator.

28. The method of claim 23, wherein the monomer complexing agent is a vinyl monomer containing a nitrogen or oxygen atom.

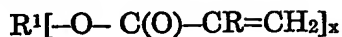
29. The method of claim 23, wherein the monomer complexing agent is vinyl acetate, vinyl ethyl ether, vinyl 2-ethylhexanoate, vinyl isobutyl ether, vinyl methyl ketone, 1-vinyl-2-pyrrolidinone or a mixture of two or more thereof.

30. The method of claim 23, wherein the monomer complexing agent is acrylamide, methacrylamide, an N,N-dialkyl acrylamide or an N,N-dialkyl methacrylamide.

31. The method of claim 23, wherein the monomer complexing agent is an acrylic or methacrylic ester.

32. The method of claim 31, wherein the acrylic or methacrylic ester has one or more ether and/or alcohol groups in the ester portion of the molecule.

33. The method of claim 32, wherein the acrylic or methacrylic ester is represented by the general structure



where R is hydrogen or methyl, x is a number that is at least 1, and R¹ is (1) the
5 residue of a compound having from 1-8 aliphatic hydroxyl groups, (2) the residue of a phenol or bisphenol.

34. The method of claim 33, wherein the acrylic or methacrylic ester is

(A) an ester of one or more moles of acrylic or methacrylic acid and a mole of propylene glycol, ethylene glycol, trimethylolpropane, neopentyl glycol,
10 pentaerythritol, glycerine, dipropylene glycol, diethylene glycol or an ethoxylated and/or propoxylated derivative of any of the foregoing,

(B) a complex ester of one or more moles of acrylic or methacrylic acid and (a) one or more moles of a C₆-C₂₄ straight chain saturated or unsaturated carboxylic acid and (b) propylene glycol, ethylene glycol, trimethylolpropane, neopentyl glycol,
15 pentaerythritol, glycerine, dipropylene glycol, diethylene glycol or an ethoxylated and/or propoxylated derivative of any of the foregoing; or

(C) a mixture of two or more of (A) and/or (B).

35. The method of claim 23, wherein volatiles are stripped from the catalyst prior to polymerization of the monomer complexing agent.

20 36. The method of claim 23, wherein volatiles are stripped from the catalyst simultaneously with the polymerization of the monomer complexing agent.

37. The method of claim 23, wherein step b is performed in the presence of a support.

38. The method of claim 37, wherein the support is a particulate silica, silica
25 chips, alumina particulates or spheres, porous alumina spheres or particulates, polyacrylate or styrene/divinylbenzene copolymer particles or catalyst substrate spheres.

39. A method of making a polyether, comprising subjecting a mixture of an alkylene oxide and an initiator compound to conditions sufficient to polymerize the
30 alkylene oxide while in the presence of the polymer of claim 11.